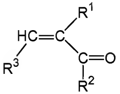
AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph no. [0023] with the following amended paragraph:

[0023] (8) The ~~propylene~~ polypropylene described in (7) above is obtained by removing a by-produced crystalline polypropylene.

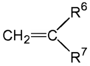
Please replace the paragraph no. [0026] bridging pages 5/6 with the following amended paragraph:

[0026] (11) The polypropylene is treated with a modifying agent represented by the following general formula (1):



• • • (1)

wherein R^1 represents a hydrogen atom, or an alkyl group having 1-10 carbon atoms; R^2 represents an OR^4 group [R^4 represents a hydrogen atom, an alkyl group having 1-10 carbon atoms, which may have a halogen group, an aromatic group which may have an alkyl group, a $-(CH_2)_a-O-P(O)(OR^1)_2$ group, a $-(CH_2)_a-O-P(O)(O^-)(O-(CH_2)_b-N^+R^1_3)$ group, wherein *a* and *b* are respectively integers of 1-5, an alkali metal selected from the group consisting of Li, Na ~~or~~ and K, an alicyclic hydrocarbon group having 5-10 carbon atoms, a glycidyl group, an $-R^5-COCR^1=CH_2$ group, wherein R^5 represents an alkylene group having 1-10 carbon atoms or a $-[(CH_2)_q-O-]_r-$ group, wherein *q* and *r* are respectively integers of 1-5, an $-R^5OR^1$ group, an $-R^5Si(OR^1)_3$ group, or an $-R^5-NCO$ group], an $-NR^1_2$ group, an $-R^5-NR^1_2$ group, or a halogen group selected from the group consisting of Cl, Br, F and I; and R^3 represents a hydrogen atom, or a $-COR^2$ group, and/or a modifying agent represented by the following general formula (2):


• • • (2)

wherein R^6 represents a hydrogen atom or an alkyl group having 1-10 carbon atoms, or a halogen group selected from the group consisting of Cl, Br, F and I; R^7 represents an -Ar-X' group (X' represents an R^6 group, an -OH group, a -COOH group, an $-NH_2$ group, a -CN group, an $-NO_2$ group, a halogenated alkyl group having 1-10 carbon atoms, a $-CH=CH_2$ group, or an $-OCO-R^6$ group), an $-OCO-R^6$ group, a -CHO group, a $-COR^6$ group, a -CN group, a pyridyl group, a pyrrolidonyl group, an $-Si(OR^1)_3$ group (R^1 represents hydrogen atom, or an alkyl group having 1-10 carbon atoms), a halogenated alkyl group having 1-10 carbon atoms, a halogen group, an -OR^6 group, an $-OSO_3M$ group (M represents an alkali metal selected from the group consisting of Li, Na ~~or~~ and K), or an $-NH-CO-R^6$ group. These definitions are similarly applicable below.

Please replace the paragraph no. [0027] with the following amended paragraph:

[0027] (12) The compound represented by the general formula (1) described in (11) above is at least one selected from the group consisting of (meth)acrylic acid and its alkyl esters, glycidyl esters, alkali metal salts of (meth)acrylic acid and its halides, and (meth)acrylic acid derivatives containing an -OH group, an alkoxyl group, an amino group ~~or~~ and an isocyanate group.

Please replace the paragraph no. [0055] with the following amended paragraph:

[0055] The polyethylene usable includes ultra-high-molecular-weight polyethylene, high-density polyethylene, intermediate-density polyethylene and low-density polyethylene. Among them, the ultra-high-molecular-weight polyethylene is preferable~~ as the polyethylene~~. The Mw of the ultra-high-molecular-weight polyethylene is preferably 5×10^5 or more, more preferably 1×10^6 to 15×10^6, particularly 1×10^6 to 5×10^6. The above-described types of polyethylene may

be copolymers containing small amounts of other α-olefins. The α-olefins other than ethylene may be propylene, butene-1, pentene-1, hexene-1, 4-methylpentene-1, octene, vinyl acetate, methyl methacrylate, styrene, etc.

Please replace the paragraph no. [0068] paragraph bridging pages 11/12 with the following amended paragraph:

[0068] The repeating units of polypropylene can have three configurations, called isotactic, syndiotactic and atactic. Isotactic polypropylene has such a stereochemical structure that asymmetric carbon atoms have the same three-dimensional arrangement along the polypropylene skeleton, namely methyl groups in continuing monomer units are arranged on the same side of a plane passing through the polypropylene skeleton (for instance, all methyl groups are above the plane). Syndiotactic polypropylene has such a stereochemical structure that two monomer units in a mirror-image isomerism relation (racemic diad: asymmetric carbon atoms in two connected monomer units are in staggering positions) are regularly arranged along the polypropylene skeleton (methyl groups in the continuing monomers units in the chain exist alternately on both sides of a hypothetical plane passing through the polypropylene skeleton). Atactic polypropylene has such a stereochemical structure that ~~the configuration of asymmetric carbon atoms is~~asymmetric carbon atoms are randomly arranged along the polypropylene skeleton.

Please replace the paragraph no. [0069] with the following amended paragraph:

[0069] A racemic diad fraction [r] is an index of the stereoregularity of polypropylene, specifically representing the syndiotacticity of polypropylene. For instance, when the racemic diad fraction [r] is 1, namely 100%, the polypropylene is totally syndiotactic. The racemic diad

fraction [r] is obtained from the integrated peak intensity of a stereoregular structure measured by well-known ~~methods, namely~~ ^{13}C-NMR.

Please replace the paragraph no. [0074] with the following amended paragraph:

[0074] The polypropylene described in (1) above is preferably produced by the polymerization of propylene in a solvent using uniform and/or non-uniform metal complex catalysts, though not restricted. The solvents may be saturated aliphatic hydrocarbons such as propane, butane, pentane, hexane, heptane, etc.; saturated alicyclic hydrocarbons such as cyclopropane, cyclohexane, etc.; aromatic hydrocarbons such as benzene, toluene, xylene, etc.; tetrahydrofuran (THF), etc. The polymerization of propylene may be conducted in a propylene ~~bulk~~ liquid or gas phase without using a solvent.

Please replace the paragraph no. [0093] with the following amended paragraph:

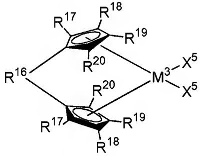
[0093] ~~The specific compounds of the above complexes (ii-1) are~~The above compleses (ii-1) are specifically $Ti(OC_2H_5)_4$, $Ti(O\text{-}n\text{-}C_3H_7)_4$, $Ti(O\text{-}i\text{-}C_3H_7)_4$, $Ti(O\text{-}n\text{-}C_4H_9)_4$, $Ti(O\text{-}i\text{-}C_4H_9)_4$, $Ti(O\text{-}s\text{-}C_4H_9)_4$, $Ti(O\text{-}t\text{-}C_4H_9)_4$, $Ti(O\text{-}cycloC_5H_9)_4$, $Ti(OC_5H_{11})_4$, $Ti(OC_6H_5)_4$, $Ti(O\text{-}cycloC_6H_{11})_4$, $Ti(OC_6H_{13})_4$, $Ti(OC_2H_5)_2Cl_2$, $Ti(O\text{-}i\text{-}C_3H_7)_2Cl_2$, $Ti(O\text{-}n\text{-}C_3H_7)_2Br_2$, $Ti(O\text{-}n\text{-}C_4H_9)_2Cl_2$, $Ti(O\text{-}i\text{-}C_4H_9)_2Br_2$, $Ti(O\text{-}s\text{-}C_4H_9)_2I_2$, $Ti(OC_5H_{11})_2Cl_2$, $Ti(O\text{-}cycloC_6H_{11})_2F_2$, $Ti[N(C_2H_5)_2]_4$, $Ti[N(n\text{-}C_3H_7)_2]_4$, $Ti[N(i\text{-}C_3H_7)_2]_4$, $Ti[N(n\text{-}C_4H_9)_2]_4$, $Ti[N(i\text{-}C_4H_9)_2]_4$, $Ti[N(s\text{-}C_4H_9)_2]_4$, $Ti[N(t\text{-}C_4H_9)_2]_4$, $Ti[N(cycloC_5H_9)_2]_4$, $Ti[N(C_5H_{11})_2]_4$, $Ti[N(C_6H_5)_2]_4$, $Ti[N(cycloC_6H_{11})_2]_4$, $Ti[N(C_6H_{13})_2]_4$, $Ti[N(C_2H_5)_2]_2Cl_2$, $Ti[N(n\text{-}C_3H_7)_2]_2Cl_2$, $Ti[N(i\text{-}C_3H_7)_2]_2Br_2$, $Ti[N(s\text{-}C_4H_9)_2]_2Cl_2$, $Ti[N(n\text{-}C_4H_9)_2]_2Br_2$, $Ti[N(t\text{-}C_4H_9)_2]_2I_2$, $Ti[N(C_5H_{11})_2]_2F_2$, $Ti[N(C_5H_{11})_2]_2Cl_2$, Ti(acetylacetonato)$_2Cl_2$, Ti(methylbutanedionato)$_2Cl_2$, Ti(butanedionato)$_2Cl_2$, Ti(benzoylacetonato)$_2Br_2$,

Ti(benzoyltrifluoroacetonato)$_2$F$_2$, Ti(dibenzoylmethanato)$_2$I$_2$, Ti(furoylacetonato)$_2$Br$_2$, Ti(trifluoroacetylacetonato)$_2$Br$_2$, Ti(2,4-hexanedionato)$_2$Cl$_2$, $Zr(OC_2H_5)_4$, $Zr(O\text{-}n\text{-}C_3H_7)_4$, $Zr(O\text{-}i\text{-}C_3H_7)_4$, $Zr(O\text{-}n\text{-}C_4H_9)_4$, $Zr(O\text{-}i\text{-}C_4H_9)_4$, $Zr(O\text{-}s\text{-}C_4H_9)_4$, $Zr(O\text{-}t\text{-}C_4H_9)_4$, $Zr(O\text{-}cycloC_5H_9)_4$, $Zr(OC_5H_{11})_4$, $Zr(OC_6H_5)_4$, $Zr(O\text{-}cycloC_6H_{11})_4$, $Zr(OC_6H_{13})_4$, $Zr(OC_2H_5)_2Cl_2$, $Zr(O\text{-}i\text{-}C_3H_7)_2Cl_2$, $Zr(O\text{-}n\text{-}C_3H_7)_2Br_2$, $Zr(O\text{-}n\text{-}C_4H_9)_2Cl_2$, $Zr(O\text{-}i\text{-}C_4H_9)_2Br_2$, $Zr(O\text{-}s\text{-}C_4H_9)_2I_2$, $Zr(OC_5H_{11})_2Cl_2$, $Zr(O\text{-}cycloC_6H_{11})_2F_2$, $Zr[N(C_2H_5)_2]_4$, $Zr[N(n\text{-}C_3H_7)_2]_4$, $Zr[N(i\text{-}C_3H_7)_2]_4$, $Zr[N(n\text{-}C_4H_9)_2]_4$, $Zr[N(i\text{-}C_4H_9)_2]_4$, $Zr[N(s\text{-}C_4H_9)_2]_4$, $Zr[N(t\text{-}C_4H_9)_2]_4$, $Zr[N(cycloC_5H_9)_2]_4$, $Zr[N(C_5H_{11})_2]_4$, $Zr[N(C_6H_5)_2]_4$, $Zr[N(cycloC_6H_{11})_2]_4$, $Zr[N(C_6H_{13})_2]_4$, $Zr[N(C_2H_5)_2]_2Cl_2$, $Zr[N(n\text{-}C_3H_7)_2]_2Cl_2$, $Zr[N(i\text{-}C_3H_7)_2]_2Br_2$, $Zr[N(s\text{-}C_4H_9)_2]_2Cl_2$, $Zr[N(n\text{-}C_4H_9)_2]_2Br_2$, $Zr[N(t\text{-}C_4H_9)_2]_2I_2$, $Zr[N(C_5H_{11})_2]_2F_2$, $Zr[N(C_5H_{11})_2]_2Cl_2$, Zr(acetylacetonato)$_2$Cl$_2$, Zr(methylbutanedionato)$_2$Cl$_2$, Zr(butanedionato)$_2$Cl$_2$, Zr(benzoylacetonato)$_2$Br$_2$, Zr(benzoyltrifluoroacetonato)$_2$F$_2$, Zr(dibenzoylmethanato)$_2$I$_2$, Zr(furoylacetonato)$_2$Br$_2$, Zr(trifluoroacetylacetonato)$_2$Br$_2$, Zr(2,4-hexanedionato)$_2$Cl$_2$, $Hf(OC_2H_5)_4$, $Hf(O\text{-}n\text{-}C_3H_7)_4$, $Hf(O\text{-}i\text{-}C_3H_7)_4$, $Hf(O\text{-}n\text{-}C_4H_9)_4$, $Hf(O\text{-}i\text{-}C_4H_9)_4$, $Hf(O\text{-}s\text{-}C_4H_9)_4$, $Hf(O\text{-}t\text{-}C_4H_9)_4$, $Hf(O\text{-}cycloC_5H_9)_4$, $Hf(OC_5H_{11})_4$, $Hf(OC_6H_5)_4$, $Hf(O\text{-}cycloC_6H_{11})_4$, $Hf(OC_6H_{13})_4$, $Hf(OC_2H_5)_2Cl_2$, $Hf(O\text{-}i\text{-}C_3H_7)_2Cl_2$, $Hf(O\text{-}n\text{-}C_3H_7)_2Br_2$, $Hf(O\text{-}n\text{-}C_4H_9)_2Cl_2$, $Hf(O\text{-}i\text{-}C_4H_9)_2Br_2$, $Hf(O\text{-}s\text{-}C_4H_9)_2I_2$, $Hf(OC_5H_{11})_2Cl_2$, $Hf(O\text{-}cycloC_6H_{11})_2F_2$, $Hf[N(C_2H_5)_2]_4$, $Hf[N(n\text{-}C_3H_7)_2]_4$, $Hf[N(i\text{-}C_3H_7)_2]_4$, $Hf[N(n\text{-}C_4H_9)_2]_4$, $Hf[N(i\text{-}C_4H_9)_2]_4$, $Hf[N(s\text{-}C_4H_9)_2]_4$, $Hf[N(t\text{-}C_4H_9)_2]_4$, $Hf[N(cycloC_5H_9)_2]_4$, $Hf[N(C_5H_{11})_2]_4$, $Hf[N(C_6H_5)_2]_4$, $Hf[N(cycloC_6H_{11})_2]_4$, $Hf[N(C_6H_{13})_2]_4$, $Hf[N(C_2H_5)_2]_2Cl_2$, $Hf[N(n\text{-}C_3H_7)_2]_2Cl_2$, $Hf[N(i\text{-}C_3H_7)_2]_2Br_2$, $Hf[N(s\text{-}C_4H_9)_2]_2Cl_2$, $Hf[N(n\text{-}C_4H_9)_2]_2Br_2$, $Hf[N(t\text{-}C_4H_9)_2]_2I_2$, $Hf[N(C_5H_{11})_2]_2F_2$, $Hf[N(C_5H_{11})_2]_2Cl_2$, Hf(acetylacetonato)$_2$Cl$_2$, Hf(methylbutanedionato)$_2$Cl$_2$, Hf(butanedionato)$_2$Cl$_2$, Hf(benzoylacetonato)$_2$Br$_2$, Hf(benzoyltrifluoroacetonato)$_2$F$_2$,

$Hf(dibenzoylmethanato)_2I_2$, $Hf(furoylacetonato)_2Br_2$, $Hf(trifluoroacetylacetonato)_2Br_2$, $Hf(2,4\text{-}hexanedionato)_2Cl_2$, etc.

Please replace the paragraph no. [0100] with the following amended paragraph:

[0100][0001] The one-cross-linked metallocene compounds may be represented, for instance, by the following general formula (14);

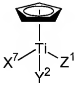


...(14)

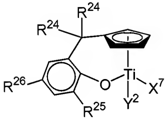
wherein M^3 represents any one metal of Ti, Zr ~~or~~ and Hf, R^{16} represents a bivalent aromatic group, a bivalent alicyclic hydrocarbon group, a bivalent aliphatic hydrocarbon group, or a bivalent organic group having a hetero-element such as oxygen, nitrogen, silicon, etc., R^{17}-R^{20} independently represent a hydrogen atom or an aliphatic hydrocarbon group having 1-8 carbon atoms, at least one of R^{17}-R^{20} being a hydrogen atom, and X^5 represents a halogen group, an aliphatic hydrocarbon group 1-8 carbon atoms, or an aromatic hydrocarbon group 6-10 carbon atoms.

Please replace the paragraph no. [0107] with the following amended paragraph:

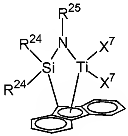
[0107] When the above catalysts (iv) are used, the above compounds (iv-1) may be represented by the following general formulae (16)-(18):



...(16)



...(17)

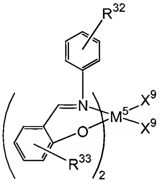


...(18)

wherein X^7, Y^2, Z^1 independently represent a halogen group selected from the group consisting of F, Cl, Br ~~or~~ and I, an aliphatic hydrocarbon group having 1-8 carbon atoms, an alkoxyl group having 1-8 carbon atoms, an aromatic hydrocarbon group having 6-14 carbon atoms, which may have a substituent group, or an alkoxyl group having 6-14 carbon atoms, and R^{24}-R^{26} independently represent an aliphatic hydrocarbon group having 1-8 carbon atoms, or an aromatic hydrocarbon group having 6-14 carbon atoms, which may have a substituent group, X^7, Y^2, Z^1 and R^{24}-R^{26} may be the same or different.

Please replace the paragraph no. [0117] with the following amended paragraph:

[0117] When the above catalysts (vii) are used, the phenoxyimine complexes of titanium, zirconium, hafnium, etc. may be represented, for instance, by the following general formula (24):

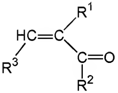


...(24)

wherein M^5 represents any one metal of Ti, Zr ~~or~~ and Hf, R^{32} and R^{33} independently represent an alkyl group having 1-5 carbon atoms, and X^9 represents F, Cl, Br or I. The aluminoxanes may be the same as the above catalysts (ii).

Please replace the paragraph no. [0133] paragraph bridging pages 29/30 with the following amended paragraph:

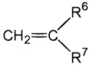
[0133] The polypropylene may be modified by methods described below, to improve adhesion to electrodes. Modifying agents usable are preferably compounds represented by the following general formula (1):



• • • (1)

wherein R^1 represents a hydrogen atom, or an alkyl group having 1-10 carbon atoms; R^2 represents an OR^4 group [R^4 represents a hydrogen atom, an alkyl group having 1-10 carbon atoms, which may have a halogen group, an aromatic group which may have an alkyl group, a $-(CH_2)_a-O-P(O)(OR^1)_2$ group, a $-(CH_2)_a-O-P(O)(O^-)(O-(CH_2)_b-N^+R^1_3)$ group, wherein *a* and *b* are respectively integers of 1-5, an alkali metal selected from the group consisting of Li, Na ~~or~~ and K, an alicyclic hydrocarbon group having 5-10 carbon atoms, a glycidyl group, an $-R^5-COCR^1=CH_2$ group, wherein R^5 represents an alkylene group having 1-10 carbon atoms or a $-[(CH_2)_q-O-]_r-$ group, wherein *q* and *r* are respectively integers of 1-5, an $-R^5OR^1$ group, an $-R^5Si(OR^1)_3$ group, or an $-R^5-NCO$ group], an $-NR^1_2$ group, $-R^5-NR^1_2$ group, or a halogen group

selected from the group consisting of Cl, Br, F and I; and R^3 represents a hydrogen atom, or a -COR^2 group, and compounds represented by the following general formula (2):



・・・(2)

wherein R^6 represents a hydrogen atom or an alkyl group having 1-10 carbon atoms, or a halogen group selected from the group consisting of Cl, Br, F and I; R^7 represents an -Ar-X' group (X' represents an R^6 group, an -OH group, a -COOH group, an -NH_2 group, a -CN group, an -NO_2 group, a halogenated alkyl group having 1-10 carbon atoms, a -$CH=CH_2$ group, or an -OCO-R^6 group), an -OCO-R^6 group, a -CHO group, a -COR^6 group, a -CN group, a pyridyl group, a pyrrolidonyl group, an -$Si(OR^1)_3$ group (R^1 represents hydrogen atom, or an alkyl group having 1-10 carbon atoms), a halogenated alkyl group having 1-10 carbon atoms, a halogen group, an -OR^6 group, an -OSO_3M group (M represents an alkali metal selected from the group consisting of Li, Na ~~or~~ and K), or -NH-CO-R^6 group.

Please replace the paragraph no. [0135] with the following amended paragraph:

[0135] Particularly preferable as the compound represented by the general formula (1) is at least one selected from the group consisting of (meth)acrylic acid and its alkyl esters, glycidyl esters, alkali metal salts of (meth)acrylic acid and their halides, and (meth)acrylic acid derivatives containing any one of a hydroxyl group, an alkoxyl group, an amino group ~~or~~ and an isocyanate group.

Please replace the paragraph no. [0140] with the following amended paragraph:

[0140] Although one modifying agent is usually used, two or more modifying agents may be used. When two or more modifying agents are used, they may be mixed before reaction

with polypropylene, but they may be added in ~~many stages such as~~ two or more stages to be reacted with polypropylene.

Please replace the paragraph no. [0147] bridging pages 33/34 with the following amended paragraph:

[0147] The fluororesin is preferably at least one selected from the group consisting of polyvinylidene fluoride, polyvinyl fluoride, vinylidene fluoride copolymers and vinyl fluoride copolymers. The amount of a vinylidene fluoride unit in the vinylidene fluoride copolymers, and the amount of a vinyl fluoride unit in the vinyl fluoride copolymers are respectively preferably 75% by mass or more, more preferably 90% by mass or more. Examples of monomers copolymerized with vinylidene fluoride or vinyl fluoride include hexafluoropropylene, tetrafluoroethylene, trifluoropropylene, ethylene, propylene, isobutylene, styrene, vinyl chloride, vinylidene chloride, difluorochloroethylene, vinyl formate, vinyl acetate, vinyl propionate, vinyl butyrate, acrylic acid and its salts, methyl methacrylate, ally methacrylate, acrylonitrile, methacrylonitrile, N-butoxymethyl acrylamide, ally acetate, isopropenyl acetate, etc. Among them, polyvinylidene fluoride and vinylidene fluoride copolymers are preferable. The vinylidene fluoride copolymers are preferably ~~poly(hexafluoropropylene-vinylidene fluoride)~~hexafluoropropylene-vinylidene fluoride copolymers.

Please replace the paragraph no. [0156] with the following amended paragraph:

[0156] In the above method (a), the removal of part of the good solvent to increase the concentration of polypropylene in the coating layer causes microphase separation to a polypropylene phase and a good solvent phase, and further removal of the remainder of the good solvent fixes the resultant phase separation, thereby forming fine pores. To obtain a structure in which the polypropylene phase and the good solvent phase are well separated microscopically,

the mixed liquid applied to the microporous polyolefin membrane is preferably air-dried at about room temperature, and then heat-dried.

Please replace the paragraph no. [0276] bridging pages 51/52 with the following amended paragraph:

[0276][0002] (8) Racemic dyad fraction [r]: Determined from the integrated value of peak intensity obtained by ^{13}C-NMR measurement under the following conditions.

Measuring apparatus: XL-200 NMR with pulse Fourier transformer PFT available from Varian Inc.,

Frequency: 50 MHz,

Temperature: 120°C,

Pulse width: 8.2 μsπ/3,

Pulse interval: 4 seconds,

Number of integration: 5,000, and

Sample: Prepared by dissolving polypropylene in a mixed ~~solution~~ solvent of trichlorobenzene and benzene (volume ratio of trichlorobenzene/benzene = 2/1).

Please replace the paragraph no. [0279-0282] Table 1 with the following amended Table 1:

[0279][0003] Table 1

No.	Example 1	Example 2	Example 3	Example 4
Microporous Polyolefin Membrane				
Polyolefin (PO)Composition				
UHMWPE Mw Content (% by mass)	 2.0×10^6 30	 2.0×10^6 30	 2.0×10^6 30	 2.0×10^6 30
HDPE Mw Content (% by mass)	 3.5×10^5 70	 3.5×10^5 70	 3.5×10^5 70	 3.5×10^5 70
(Mw/Mn)/Tm (°C)/Tcd (°C)$^{(1)}$	16.8/135/90	16.8/135/90	16.8/135/90	16.8/135/90
Melt Blend				
Membrane-Forming Solvent	Liquid	Liquid	Liquid	Liquid

	Paraffin	Paraffin	Paraffin	Paraffin
Conc. of PO Composition (% by mass)	30	30	30	30
Membrane-Forming Conditions				
Stretching Temperature (°C)	112	112	112	112
Stretching Magnification (MD x TD)(2)	5 x 5	5 x 5	5 x 5	5 x 5
Heat-Setting Temp. and Time (°C/min.)	125/10	125/10	125/10	125/10
Properties of Microporous Polyolefin Membrane				
Thickness (μm)	23.2	23.2	23.2	23.2
Porosity (%)	39.6	39.6	39.6	39.6
Air Permeability (sec/100 cc)	514	514	514	514
Pin Puncture Strength (mN)	6370	6370	6370	6370
Shutdown Temperature (°C)	135	135	135	135
Meltdown Temperature (°C)	160	160	160	160
Polypropylene Coating Layer				
Polypropylene (PP)				
Mw	68000	68000	68000	10000
Mw/Mn	1.5	1.5	1.5	2
Solubility in Toluene(3) [g/100g (25°C)]	≥15	≥15	≥15	≥15
Racemic Diad Fraction [r]	0.79	0.79	0.79	0.59
Coating Conditions				
Coated Surface	Both Surfaces	Both Surfaces	Both Surfaces	Both Surfaces
Conc. of PP solution (% by mass)	2	5	8	2
Coating Layer				
Coated PP (g/m^2)	0.78	1.68	2.25	0.96
Uniformity	Good	Good	Good	Good
Properties of Microporous Composite Membrane				
Thickness (μm)	23.4	23.9	24.3	23.5
Porosity (%)	37.4	32.6	29.8	34.5
Air Permeability (sec/100 cc)	765	1468	1781	1092
Pin Puncture Strength (mN)	6517	6762	7154	6566
Shutdown Temperature (°C)	135	135	135	135
Meltdown Temperature (°C)	165	165	165	160
High-Temperature Storability of Lithium Secondary Battery				
Capacity Recovery Ratio (%)(4)	75	80	>80	75

[0280] Table 1 (continued)

No.	Example 5	Example 6	Example 7	Comp. Ex. 1
Microporous Polyolefin Membrane				
Polyolefin (PO)Composition				
UHMWPE Mw Content (% by mass)	 2.0×10^6 30	 2.0×10^6 30	 2.0×10^6 30	 2.0×10^6 30
HDPE Mw Content (% by mass)	 3.5×10^5 70	 3.5×10^5 70	 3.5×10^5 70	 3.5×10^5 70
(Mw/Mn)/Tm (°C)/Tcd (°C)[1]	16.8/135/90	16.8/135/90	16.8/135/90	16.8/135/90
Melt Blend				
Membrane-Forming Solvent	Liquid Paraffin	Liquid Paraffin	Liquid Paraffin	Liquid Paraffin
Conc. of PO Composition (% by mass)	30	30	30	30
Membrane-Forming Conditions				
Stretching Temperature (°C)	112	112	112	112
Stretching Magnification (MD x TD)[2]	5 x 5	5 x 5	5 x 5	5 x 5
Heat-Setting Temp. and Time (°C/min.)	125/10	125/10	125/10	125/10
Properties of Microporous Polyolefin Membrane				
Thickness (μm)	23.2	23.2	23.2	23.2
Porosity (%)	39.6	39.6	39.6	39.6
Air Permeability (sec/100 cc)	514	514	514	514
Pin Puncture Strength (mN)	6370	6370	6370	6370
Shutdown Temperature (°C)	135	135	135	135
Meltdown Temperature (°C)	160	160	160	160
Polypropylene Coating Layer				
Polypropylene (PP)				
Mw	260000	51000	68000	-
Mw/Mn	1.1	2.0	1.5	-
Solubility in Toluene[3] [g/100g (25°C)]	≥15	≥15	≥15	-
Racemic Diad Fraction [r]	0.7	0.17	0.79	-
Coating Conditions				
Coated Surface	Both Surfaces	Both Surfaces	One Surface	-
Conc. of PP solution (% by mass)	5	2	2	-
Coating Layer				
Coated PP (g/m^2)	1.21	0.83	0.51	-
Uniformity	Good	Good	Good	-
Properties of Microporous Composite Membrane				
Thickness (μm)	23.8	23.8	23.5	-

Porosity (%)	35.2	36.8	36.8	-
Air Permeability (sec/100 cc)	954	802	746	-
Pin Puncture Strength (mN)	6566	6664	6468	-
Shutdown Temperature (°C)	135	135	135	-
Meltdown Temperature (°C)	165	165	165	-
High-Temperature Storability of Lithium Secondary Battery				
Capacity Recovery Ratio (%)(4)	80	80	75	60

[0281] Table 1 (continued)

No.	Comp. Ex. 2	Comp. Ex. 3	Comp. Ex. 4	Comp. Ex. 5
Microporous Polyolefin Membrane				
Polyolefin (PO) Composition				
UHMWPE				
Mw	2.0×10^6	2.0×10^6	2.0×10^6	2.0×10^6
Content (% by mass)	30	30	30	30
HDPE				
Mw	3.5×10^5	3.5×10^5	3.5×10^5	3.5×10^5
Content (% by mass)	70	70	70	70
(Mw/Mn)/Tm (°C)/Tcd (°C)(1)	16.8/135/90	16.8/135/90	16.8/135/90	16.8/135/90
Melt Blend				
Membrane-Forming Solvent	Liquid Paraffin	Liquid Paraffin	Liquid Paraffin	Liquid Paraffin
Conc. of PO Composition (% by mass)	30	30	30	30
Membrane-Forming Conditions				
Stretching Temperature (°C)	112	112	112	112
Stretching Magnification (MD x TD)(2)	5 x 5	5 x 5	5 x 5	5 x 5
Heat-Setting Temp. and Time (°C/min.)	125/10	125/10	125/10	125/10
Properties of Microporous Polyolefin Membrane				
Thickness (μm)	23.2	23.2	23.2	23.2
Porosity (%)	39.6	39.6	39.6	39.6
Air Permeability (sec/100 cc)	514	514	514	514
Pin Puncture Strength (mN)	6370	6370	6370	6370
Shutdown Temperature (°C)	135	135	135	135
Meltdown Temperature (°C)	160	160	160	160
Polypropylene Coating Layer				
Polypropylene (PP)				
Mw	68000	68000	3000	94000
Mw/Mn	1.5	1.5	1.4	1.8
Solubility in Toluene(3) [g/100g (25°C)]	≥15	≥15	≥15	≤0.1
Racemic Diad Fraction [r]	0.79	0.79	0.66	0.94
Coating Conditions				
Coated Surface	Both Surfaces	Both Surfaces	Both Surfaces	-
Conc. of PP solution (% by mass)	0.2	12	2	2(5)
Coating Layer				
Coated PP (g/m²)	0.03	5.81	2.55	-
Uniformity	Good	Poor	Good	-
Properties of Microporous Composite Membrane				
Thickness (μm)	23.3	28.1	24.6	-

Porosity (%)	39.5	26.5	27.2	-
Air Permeability (sec/100 cc)	519	21216	19456	-
Pin Puncture Strength (mN)	6370	7252	6468	-
Shutdown Temperature (°C)	135	135	135	-
Meltdown Temperature (°C)	160	165	160	-
High-Temperature Storability of Lithium Secondary Battery				
Capacity Recovery Ratio (%)[(4)]	60	65	60	-

[0282] Table 1 (continued)

No.	Comp. Ex. 6	Comp. Ex. 7	Comp. Ex. 8(6)	Comp. Ex. 9(7)
Microporous Polyolefin Membrane				
Polyolefin (PO) Composition				
UHMWPE				
Mw	2.0×10^6	2.0×10^6	-	-
Content (% by mass)	30	30	-	-
HDPE				
Mw	3.5×10^5	3.5×10^5	-	-
Content (% by mass)	70	70	-	-
(Mw/Mn)/Tm (°C)/Tcd (°C)(1)	16.8/135/90	16.8/135/90	-	-
Melt Blend				
Membrane-Forming Solvent	Liquid Paraffin	Liquid Paraffin	-	-
Conc. of PO Composition (% by mass)	30	30	-	-
Membrane-Forming Conditions				
Stretching Temperature (°C)	112	112	-	-
Stretching Magnification (MD x TD)(2)	5 x 5	5 x 5	-	-
Heat-Setting Temp. and Time (°C/min.)	125/10	125/10	-	-
Properties of Microporous Polyolefin Membrane				
Thickness (µm)	23.2	23.6	-	-
Porosity (%)	39.6	39.6	-	-
Air Permeability (sec/100 cc)	514	514	-	-
Pin Puncture Strength (mN)	6370	6370	-	-
Shutdown Temperature (°C)	135	135	-	-
Meltdown Temperature (°C)	160	160	-	-
Polypropylene Coating Layer				
Polypropylene (PP)				
Molecular Weight (Mw)	142000	142000	-	-
Mw/Mn	5.7	5.7	-	-
Solubility in Toluene(3) [g/100g (25°C)]	≤0.1	≤0.1	-	-
Racemic Diad Fraction [r]	0.01	0.01	-	-
Coating Conditions				
Coated Surface	-	Both Surfaces	-	-
Conc. of PP solution (% by mass)	2(5)	2	-	-
Coating Layer				
Coated PP (g/m²)	-	-	-	-
Uniformity	-	-	-	-
Properties of Microporous Composite Membrane				
Thickness (µm)	-	Ruptured	25	25
Porosity (%)	-	-	35	38

Air Permeability (sec/100 cc)	-	-	700	550
Pin Puncture Strength (mN)	-	-	3773	4312
Shutdown Temperature (°C)	-	-	165	145
Meltdown Temperature (°C)	-	-	175	175
High-Temperature Storability of Lithium Secondary Battery				
Capacity Recovery Ratio (%)[(4)]	-	-	>80	>80